# A NEW SPECIES OF *PORTULACA* (PORTULACACEAE)

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ABSTRACT

*Portulaca yecorensis* is described from the conglomeritic mudflow barrens at 1500–1600 m elevation in the Yécora valley in the Sierra Madre of eastern Sonora, Mexico. This annual is related to *P. oleracea* and *P. retusa* but differs in small size, strong reddish pigmentation, smaller seeds, larger flowers and pollen, distribution, and habitat.

RESUMEN

Se describe la especie nueva *Portulaca yecorensis* del Valle de Yécora de la Sierra Madre Occidental en la parte oriental de Sonora, México; crece en áreas con conglomerados de lodolita casi sin vegetación. Esta especie anual está relacionada con *P. oleracea* y *P. retusa*, pero difiere de éstas por su tamaño pequeño, pigmentación rojiza fuerte, semillas más pequeñas, flores y polen más grandes, distribución, y hábitat.

KEY WORDS: *Portulaca*, Portulacaceae

## INTRODUCTION

As part of their floristic surveys in the Sierra Madre Occidental of eastern Sonora, México, Tom Van Devender and Ana L. Reina G. encountered a surprisingly rich flora on gentle hills and level areas at about 1500–1600 m elevation near Yécora, Sonora. The plants growing on barren, apparently edaphically severe sites, are of particular interest. These surfaces are on debris and conglomerate deposits in the Báucarit Formation that formed as mudflows sometime after the beginning of the modern basin and range morphology (17 million years ago, Cochemé & Demant 1991).

With a mean annual rainfall of 913 mm/yr at Yécora (Búrquez et al. 1992), the vegetation is grassland in the valley bottom and pine-oak forest on the surrounding slopes (Reina et al. 1999). Dominant trees in pine-oak forest are *Pinus engelmannii* (Apache pine) and *P. yecorensis* (Yécora pine). Other common forest trees include *P. chihuahuana* (Chihuahua pine), *Quercus arizonica* (Arizona oak), *Q. chihuahuensis* (Chihuahua oak), *Q. durifolia*, *Q. oblongifolia* (Mexican blue oak), *Q. viminea* (willowleaf oak), and *Juniperus deppeana* (táscate,

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alligator bark juniper). East of Yécora, shallow soils on mudflow surfaces support open oak woodland-grassland transition with common *Q. chihuahuensis* and *Q. toumeyi* (Toumey oak).

Considering the moderately high rainfall at Yécora, bare areas without vegetation and minimal soil development on the mudflow surfaces are not easily understood. Perhaps erosion rates are excessive. In the spring, the surfaces are very dry with few visible plants. However, from July through September, heavy rainfall keeps the surfaces wet and a diverse dwarf herb flora flourishes including sedges (10 species in 7 genera), succulents (*Agave polianthiflora*, *Echinocereus stoloniferus* var. *tayopensis*, *Mammillaria saboae* var. *haudeana*, *M. wrightii* var. *wilcoxii*, *Sedum vinicolor*, *Talinum marginatum*), grasses (*Microchloa kunthii*, *Muhlenbergia annua*, *M. shepherdii*, *M. texana*), legumes (*Aeschynomene americana* var. *glandulosa*, *Dalea confusa*, *D. filiformis*, *Stylosanthes* sp.), and many others. Thus far, four taxa have been described as new from the mudflow areas including *Mammillaria saboae* var. *haudeana* (A. Lau & Wagner) Glass & R. Foster, *Menodora yecorana* T. Van Devender & B.L. Turner, *Pectis vandevenderi* B.L. Turner, and *Tridax yecorana* B.L. Turner. A new *Boerhavia* known only from these mudflow surfaces is under study by Richard Spellenberg and Luis A. Pérez. To this list, we add a small, reddish, annual succulent *Portulaca*.

## TAXONOMY

**Portulaca yecorensis** Henrickson & T.Van Devender, sp. nov. (**Figs. 1, 2**).

TYPE: MEXICO. SONORA: Municipio de Yécora, 5.0 km NW of Yécora on road to Mesa Grande, sparse pine-oak forest on level mudflow deposits, 28°24'27"N, 108°57'32"W, 1600 m, 29 Sep 1998, *T. R. Van Devender 98-1942, with A.L. Reina G., W. Trauba* (HOLOTYPE: ARIZ; ISOTYPES: CAS, TEX, MEXU).

Plantae annuae, rubro-marroniae; folia leviter compressae, 2–7.5 mm longae, 1.5–3.5 mm latae, petioli curtae; flores 10–20 mm diametro, petala aureae, fortiter emarginatae; stamina 12–17; lobi styli 3–4; seminae 0.7–0.8 mm longae, parum compressae.

Apple red to nearly maroon, succulent, low, spreading-ascending annuals, locally common on exposed shallow-soiled mudflow surfaces, the plants (1–)2.5–5.0(–10.5) cm in diameter; stems 0.7–1.0 mm in diameter, alternate or opposite branched, with internodes 0.5–8 mm long. Leaves fleshy, the blades ovate to obovate, 2–7.5 mm long, 1.5–3.5 mm wide, slightly compressed, obtuse to rounded at the tip, broadly obtuse-rounded at the base above obscure petioles 0.2–0.7 mm long; axillary hairs very sparse, obscure, to 0.3 mm long. Flowers 2–3(–4) at the stem tips where subtended by clusters of sessile leaves; bracts 3, fleshy-membranous, ovate, reddish, conduplicate, attached along a broad base, obtuse, the bracts 1–1.8 mm long, the paired bractlets 0.9–1.2 mm long, all persistent; pedicels ca. 0.5–0.7 mm long, ca. 0.7 mm wide, expanding to 1.5–2.5 mm wide at the lower hypanthial margin; sepals 2, apple red, glabrous, conduplicate with one external

FIG. 1. *Portulaca yecorensis*, from the type collections 5 km NW of Yécora, Sonora, 29 Sep 1998, *T.R. Van Devender et al., 98-1942*, showing the large flowers and contrasting reddish foliage. Horizontal bar = 1 mm.

to the other, fleshy with membranous margins, obtuse at the cucullate tip, slightly keeled above, but not crested below the tip, 3–3.5 mm long in flower, enlarging to 5.5 mm long in fruit, the two sepals connate for 0.5 mm at the base; petals 5, spreading, bright yellow, obovate, (4.5–)6–8(–9) mm long, to (4–)5–6(–7) mm wide at the tip, strongly emarginate with an apical notch to ca. 1.0–1.8 mm deep, the flowers averaging 14.7 mm in total diameter (range 10–20 mm, n=30, field measured), the petals connate and adnate to the sepals for about 0.4 mm at the sepal base; stamens (12–)15–17; filaments 5.5–6.5 mm long, bright yellow, ascending, glabrous, adnate to the petal-sepal bases for ca. 0.4 mm; anthers ca. 0.8–1.0 mm long, bright yellow, with 4 elongate thecae, each ca. 0.2 mm in diameter (wet), the two pair of anther sacs slightly twisted (i.e., not perfectly parallel); pollen globose, polyporate, (72–)90–98(–119) µm in diameter, light to strong yellow; style exserted beyond the stamens, bright yellow, 7.6–9 mm long, the lobes 3–4, 1.5–2.5 mm long, the stigmatic surfaces long papillae with some hairs to 0.3 mm long; ovules to 24. Ovary top obconic, to 1 mm long in flower to 2.5 mm long, and 2.5 mm in basal diameter in fruit, the fruit wall thin, with a slight constriction in the upper third; seeds (5–)10–19 per ovary, reddish-black with a slight oil sheen, cucullate with a whitish patch


FIG. 2. SEM of seed sculpturing patterns of *Portulaca yecorensis*: A. Edge view, showing series of small papilli across the rim. B. Face view, showing outline of fruit, and the multiradiate cells in the lower left. C. Oblique view, enlarged showing the cells with branched radii and the taller papillate cells in the lower left. White bars = 1 mm in A and B, 0.3 mm in C.

where attached to the funiculus at the radicle bulge, 0.7–0.8(–0.86) mm wide, to 0.5–0.56 mm thick, with some lateral cells tuberculate (Figs. 1, 2).

Additional specimens: **MÉXICO. Sonora. Municipio de Yécora:** 2 km E of Yécora 28°22'51"N, 108°54'53"W, 1600 m, 3 Sep 1996, *A. Flores M. 4930, J. Sánchez E.* (USON); 3.4 km N of Yécora on road to Agua Blanca, oak woodland on bare volcanic hilltops, 28°29'35"N, 108°55'11"W, 1520 m, 23 Sep 1997, *A. L. Reina G. 97-1194, T. R. Van Devender, W. Trauba*(ARIZ, HUNT, NY, TEX, USON); ca. 1 km ESE of La Otra Banda (the Pima Indian portion of Yécora) on road to Talayotes, open pine-oak forest on locally bare mudflow surfaces, 28°21'42"N, 108°54'12"W, 1600 m, 19 Nov 1997 *A. L. Reina 97-1519, with T. R. Van Devender, A. M. Rea, C. Cassa, A. E. Gondor* (ARIZ); 2 km E of Yécora, 28°22'51"N, 108°54'53"W, 1600 m, 3 Sep 1996, *A. Flores M. 4930, J. Sánchez* (USON).

The new taxon appears related to the *Portulaca oleracea* complex. Like *P. oleracea*, the plant is largely glabrous, moderately branched, and has crested sepals, small axillary hairs, and yellow flowers. The new taxon differs from *P. oleracea* in its much smaller size, smaller leaves, the distinctive reddish color on all vegetative portions, the smaller and more sparse axillary hairs, much larger flowers, larger pollen grains, poorly developed crest or keel on the sepals, and seed shape and sculpturing (Fig. 1). The small size and smaller leaves are, of course, a factor of its exposed, shallow-soil habitat and are features not restricted to this species, as *P. oleracea*, in similar habitats, may be equally reduced. The red coloration caused by the presence of betalain pigments in the outermost epidermis layer, is apparently a genetically fixed feature allowing adaptation to the exposed, high-insolation habitat. Axillary hairs are few and very short, measuring to 0.3 mm in length. In *P. oleracea* they are slightly more conspicuous, extending to 1 mm in length. *Portulaca oleracea* has very small flowers (5–10 mm in diameter) while those of

the new species are 10–20 mm in diameter, as measured in the field by Van Devender and Reina.

*Portulaca oleracea* is commonly reported as autogamous with flowers opening for only about four hours during a day (Matthews et al. 1993; Geesink 1969). The larger and more showy flowers of *P. yecorensis* are more conspicuous, a feature that may be associated with attracting pollinators and possibly outbreeding. The sphaeroidal, polyporate, pollen grains of *P. yecorensis* are very large, measuring (72–)90–98(–119) µm in diameter; pollen of *P. oleracea* is much smaller, 55–69 µm in diameter, but otherwise similar in structure. Anthers in the new species are also much larger, 0.8–1 mm long (wetted). Anthers of *P. oleracea* are about 0.5 mm in length (similarly wetted). Seeds in the new species measure 0.68–0.83 in maximum diameter, which is comparable to those of *P. oleracea*, but the body of the seed is more globose, not compressed as in *P. oleracea*. The seed surface sculpturing pattern observed in the new taxon gives evidence of its relationship. There are rows of cells on the lateral surfaces of the body that are used to characterize the sculpturing of the seeds (Danin 1978). The surface patterns found in the new species are not entirely consistent, however, most lateral surface cells have a slight metallic sheen and are stellate, to 0.2 mm wide, and have broad or narrow, unbranched to forked or truncated radii that interlock with those of adjacent cells (Fig. 2). In some seeds this pattern is very similar to that of *P. retusa* Engelm. (=*P. oleracea* L. subsp. *impolita* Danin & H.G. Baker) except that distinct tubercules are absent except from some cells on the lateral walls. In other seeds the sculpturing pattern is more obscure, but the pattern found is more like that of *P. retusa* than those of *P. oleracea*. This leads me to consider that the new species may be more closely related to *P. retusa* than *P. oleracea*, if relationship indeed falls within this group. Matthews et al. (1993) recently combined *P. retusa* with *P. oleracea*; the senior author is in strong disagreement with this action.

The contrasting dark red foliage and large, bright yellow petals make the plant very conspicuous. Red vegetative pigmentation is a common stress response in many succulent and non-succulent species (e.g., *Amaranthus, Portulaca, Sedum*) in answer to high insolation. This commonly develops over a season as light stress increases. However, its development can be controlled genetically. Danin et al. (1978) note that some cultivated subspecies of *P. oleracea* characteristically developed pigmentation of the sepals, etc., while other subspecies would not, which would indicate genetic control of pigment placement. The red pigments are betalains (Clement & Mabry 1996) and, in this taxon, are largely confined to epidermal layers. Such red pigments would reflect red and absorb green wavelengths of light, while the green chlorophyll pigment would absorb the remaining red and reflect green

wavelengths; this to some extent reduces absorptivity of solar radiation (Von Willert et al. 1992). In areas of high insolation, however, this does not impede the light available for photosynthesis. The result is dark (apple) red or maroon foliage. In the new species all vegetative portions of the plant (stems, leaves, sepals) had the distinctive, dark red coloration and this developed from the beginning—it was present throughout seedling stage into the adult plant, irregardless of the amount of light given to the plant. Even seedlings grown in the senior author's shaded, north-facing office window developed and retained the characteristic apple-red pigmentation on all vegetative structures.

The mudflow barren habitat is so open that the plants are fully exposed throughout their two to three month life span. Surveys in this habitat on August 17, 1998, revealed seedling *Sedum vinicolor* but not *Portulaca yecorensis*. Peak flowering collections were made on September 23, 1997, and September 29, 1998, nearing the end of the summer monsoon rains. The November 19, 1997, collection was mostly of dead, dried plants. It is interesting to note that the life cycle of *P. yecorensis* appears to be delayed compared to the annual composites (*Pectis vandevenderi*, *Tridax yecorana*) which senesce in October. Likely the succulent leaves allow it to persist longer than non-succulent annuals after the summer rains taper off.

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